Annual Report
2017 Aquatic Vegetation Management Program
Lost Lake & Knops Pond
Groton, Massachusetts

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INTRODUCTION

The Groton Lakes Association and the Town of Groton contracted SOLitude Lake Management (SLM) in 2017 to conduct an aquatic plant management program at Lost Lake/Knops Pond. Over the past few years, the aquatic plant management program at LL/KP has focused on managing re-growth of variable watermilfoil (*Myriophyllum heterophyllum*), curly-leaf pondweed (*Potamogeton crispus*) and fanwort (*Cabomba caroliniana*). The Project Completion Report for the 2017 Aquatic Management Program follows. This report will serve to document the herbicide application process, the pre- and post-treatment monitoring of aquatic vegetation in the lake, with a single grab of an algae sample to monitor potential algae blooms.

All work performed in 2017 was conducted in accordance with the Order of Conditions (OOC) (#169-1086) issued by the Groton Conservation Commission and the License to Apply Chemicals issued by the MA DEP – Office of Watershed Management (#17237).

A chronology of the 2017 management program and brief description of events follows.

- Pre-Treatment Survey ..... May 19
- DEP License to Apply Chemicals issued ..... May 18
- Reward/Clipper treatment for milfoil/fanwort management.....June 12
- Post-Treatment Survey..... August 24

2017 HERBICIDE TREATMENT PROGRAM

Pre-treatment Survey:

The pre-treatment survey of Lost Lake and Knops Pond was performed on May 19th by a SLM biologist. During the survey, the entire waterbody was toured with a 10ft jon boat. A throw-rake and underwater

camera was used to gain view of the entire water column. Aquatic plant species were identified and general distribution of species type, density, and location were recorded. The table below details the species observed during both the pre-and post-treatment surveys.

Origin	Common Name	Scientific Name
Native	Robbin's pondweed	*Potamogeton robbinsii*
	Tape grass	*Vallisneria americana*
	Ribbon-leaf pondweed	*Potamogeton epihydrus*
	Common bladderwort	*Utricularia vulgaris*
	Purple bladderwort	*Utricularia purpurea*
	Floating bladderwort	*Utricularia minor*
	White water lily	*Nymphaea odorata*
	Yellow water lily	*Nuphar lutea*
	Water-shield	*Brasenia schreberi*
	Arrowhead	*Sagittaria sp.*
Non-native, invasive	Variable watermilfoil	*Myriophyllum heterophyllum*
	Fanwort	*Cabomba caroliniana*
	Curly-leaf pondweed	*Potamogeton crispus*

Similar to prior years, the plant composition was dominated by Robbins pondweed (*Potamogeton robbinsii*) and tapegrass (*Vallisneria americana)*. Variable watermilfoil growth was most commonly observed on the southern shoreline of Lost Lake with a few individual patches in the northern-most cove. Variable watermilfoil in Knops Pond was present along much of the north-eastern shoreline. At that time, the plants were actively growing through much of the water column to within 2-3' of the surface. No Eurasian watermilfoil or European Naiad was observed during this time.

Curly-leaf pondweed has rapidly dispersed along much of the shoreline of both Lost Lake and Knops Pond. This species begins its new growth during the fall of the prior year and reaches maturity by late May to June. It then drops its seeds, known as turions, and thus, begins to senesce. The adult plant drops from the water column through July and August.

Refer to Figure 1 (attached) which shows the distribution of curly-leaf pondweed, fanwort, and variable watermilfoil as observed during the pre-treatment survey.

Image 1: A collection of Curly-leaf Pondweed on a throw-rake

Herbicide Treatment:

Based on the stage of target plant growth observed during the survey, treatment was scheduled for early June. Notifications of the treatments were published in the *Lowell Sun* and signs displaying water use restrictions were posted around the shoreline by the Groton Lakes Association. Treatment at Lost Lake and Knops Pond was performed on June 12th. Treatment focused on areas of dense milfoil, curlyleaf pondweed and fanwort growth identified during the pre-treatment survey. Ultimately, Reward (diquat) & Clipper (flumioxazin) herbicide was applied to target specific areas totaling 74 acres (See Figure 2). Copper sulfate was tank mixed in many of the treatment areas to provide control of sparse to moderate filamentous algae present at the time of application.

Unlike previous years and partly due to the reduced acreage of milfoil growth, areas of curlyleaf pondweed were directly targeted with this year's herbicide treatment.

The treatment was applied using an airboat equipped with a low pressure pump and a calibrated spraying system. The herbicide was diluted with lake water in an onboard mixing tank and evenly applied sub-surface to the target treatment areas using weighted hoses. Treatment area boundaries were pre-loaded onto a GPS unit that was used for real-time navigation to ensure that the herbicide was evenly applied throughout the designated areas.

The treatments were completed by SOLitude Lake Management's state certified aquatic applicators and were conducted in accordance with the product label directions.

Post-Treatment Survey:

A post-treatment survey was performed on September 23rd. Survey methodologies replicated techniques of the pre-treatment survey. All species mentioned in Table 1 were present during the post-treatment survey. Similar to the pre-treatment survey, Robbins Pondweed (*P. robbinsii)* and tapegrass (*Vallisneria americana)* were the most abundant species detected in Lost Lake and Knops Pond. The shallow nature of this waterbody allows for ample growth of these two submerged species. Three bladderwort species, common bladderwort (*U. vulgaris)*, purple bladderwort (*U. purpurea)*, and floating bladderwort (*U. minor)* were commonly found in varying densities growing in coves, with the most significant growth occurring throughout Knops Pond among large masses of filamentous algae White water lilies (*Nymphaea odorata*) were recolonizing prior habitats, primarily coves with neighboring growth of yellow water lily (*Nuphar lutea*) and common water-shield (*Brasenia schreberi*). Please refer to Figure 4 for distribution of native aquatic vegetation.

Image 2: Purple bladderwort flower (purple) next to flowering common bladderwort (yellow).

Milfoil density was greatly reduced within the treatment areas. Regrowth typically was observed in trace to sparse densities occurring as new shoots with bright green crowns growing from below the area affected by the treatment. These plants were affected by the treatment with their top halves defoliated. The greatest variable watermilfoil growth was found in the southern cove of Knops Pond. This cove was outside of the treatment zones during 2017.

Five areas of fanwort growth were documented in Lost Lake and two areas within Knops Pond during the time of the survey. One patch was bordering the Lost Lake/Knops Pond channel while the thickest patch was observed along Radio Road and Island Road in Knops Pond. No viable fanwort was observed in Springy Cove following the intensive Sonar (fluridone) herbicide treatments conducted in 2016 (please refer to Figure 3).

Water Quality

On August 23rd, a surface water algae sample was collected from Lost Lake. Blue/green cell counts were observed at 540 cells/mL. The results of this sample determine the microscopic cyanobacteria level to be well below the contact threshold recommended by the Massachusetts Department of Public Health (70,000 cells/mL).

RECOMMENDATIONS FOR ONGOING MANAGEMENT

Variable Watermilfoil Management (and other non-native or nuisance species):

The diquat herbicide treatment performed in 2017 provided desirable, season-long watermilfoil control at Lost Lake and Knops Pond. Despite some watermilfoil re-growth in a few treatment areas with higher water exchange, distribution observed during the post-treatment survey was greatly reduced in comparison to pre-treatment conditions. Consistent with prior years, we recommend that treatment target the most problematic areas of milfoil growth where there is increased potential for fragmentation and spread. If possible, based on total potential treatment acreages and funding availability, we recommend also targeting curlyleaf pondweed growth at the same time as the milfoil treatment.

Should bladderwort management be required in 2017, we recommend treating with a combination of Reward and copper-based algaecide, to increase plant efficacy, and potentially treating in early July. Reportedly, bladderwort was quite problematic in 2016, especially in Knops Pond and growth can be cyclical with varying periods of dense growth from year to year. While the Reward treatment will serve to knock-back some of the bladderwort that is starting to grow within the milfoil treatment areas, the timing and dose of the milfoil treatment is not ideal for its control.

Reward (diquat) herbicide continues to be a cost-effective herbicide for annual management of several invasive and nuisance species that are found in the lake. Variable watermilfoil and curly-leaf pondweed are both susceptible to diquat. Fanwort is the only invasive plant presently established in Lost Lake and Knops Pond that does not respond to diquat herbicide.

Fanwort Management:

Good carry-over control of fanwort has been generally been observed since the 2013 whole lake Sonar (fluridone) treatments and occasional spot-treatments (Springy Cove with Sonar herbicide in 2016 & Martins Pond Brook Cove with Clipper herbicide in 2017) have helped to extend its duration. This year substantial growth of fanwort was observed in the late season survey as compared to only scattered areas in past years.

Given the historic extent of fanwort growth in Lost Lake and Knops Pond it is unlikely that any significant control of fanwort will be achieved with large-scale hand-pulling or suction harvesting programs; these techniques should be considered only for areas of limited/scattered re-growth observed in 2018. For larger-scale growth of fanwort, treatment with either Sonar herbicide or Clipper (flumioxazin) herbicide will need to be considered. These are the only two herbicides approved for use in Massachusetts that provide control of fanwort.

Ideally, areas of fanwort re-growth would be treated with the systemic Sonar (fluridone) herbicide, however treatment of small areas or areas with high dilution can be challenging. Clipper is another option, but currently the use of Clipper is heavily regulated in Massachusetts and treatment of a specific area is limited to once every four years unless it's in the immediate vicinity of shoreline structure (i.e. like a beach, dock, intake, spillway, etc.)

Where applicable, we would recommend a low-dose treatment approach using a combination of Sonar pellet formulations. While historically fluridone has not been cost-effective for spot-treatments due to its high solubility and the need for extended contact-time, new time-release pellet formulations have been developed in recent years that have helped improve efficacy and reduce cost for spot-treatment programs. Clipper can be considered in areas where Sonar treatment would not be effective.

We will plan to work with the Association to further develop the fanwort management plan for 2018.

FIGURE 1: Pre-treatment Distribution of Target Invasive Aquatic Vegetation

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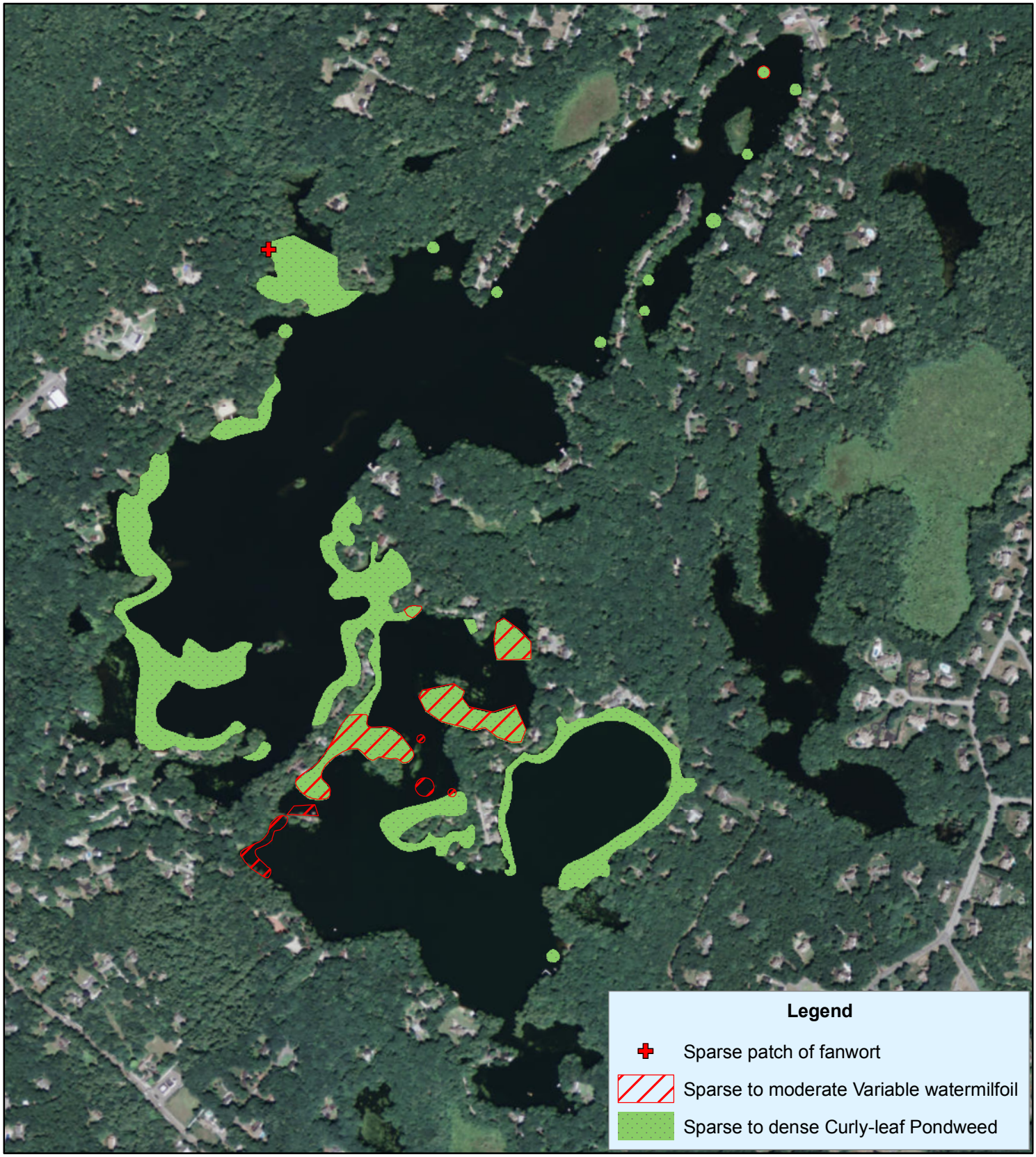

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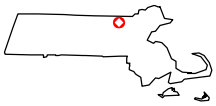
Groton, MA



Lost Lake - Knops Pond

0 770 1,540
Feet
1:9,500

N

Map Date: 05-20-17
Prepared by: ALM
Office: SHREWSBURY, MA

FIGURE 2: Proposed Treatment Areas

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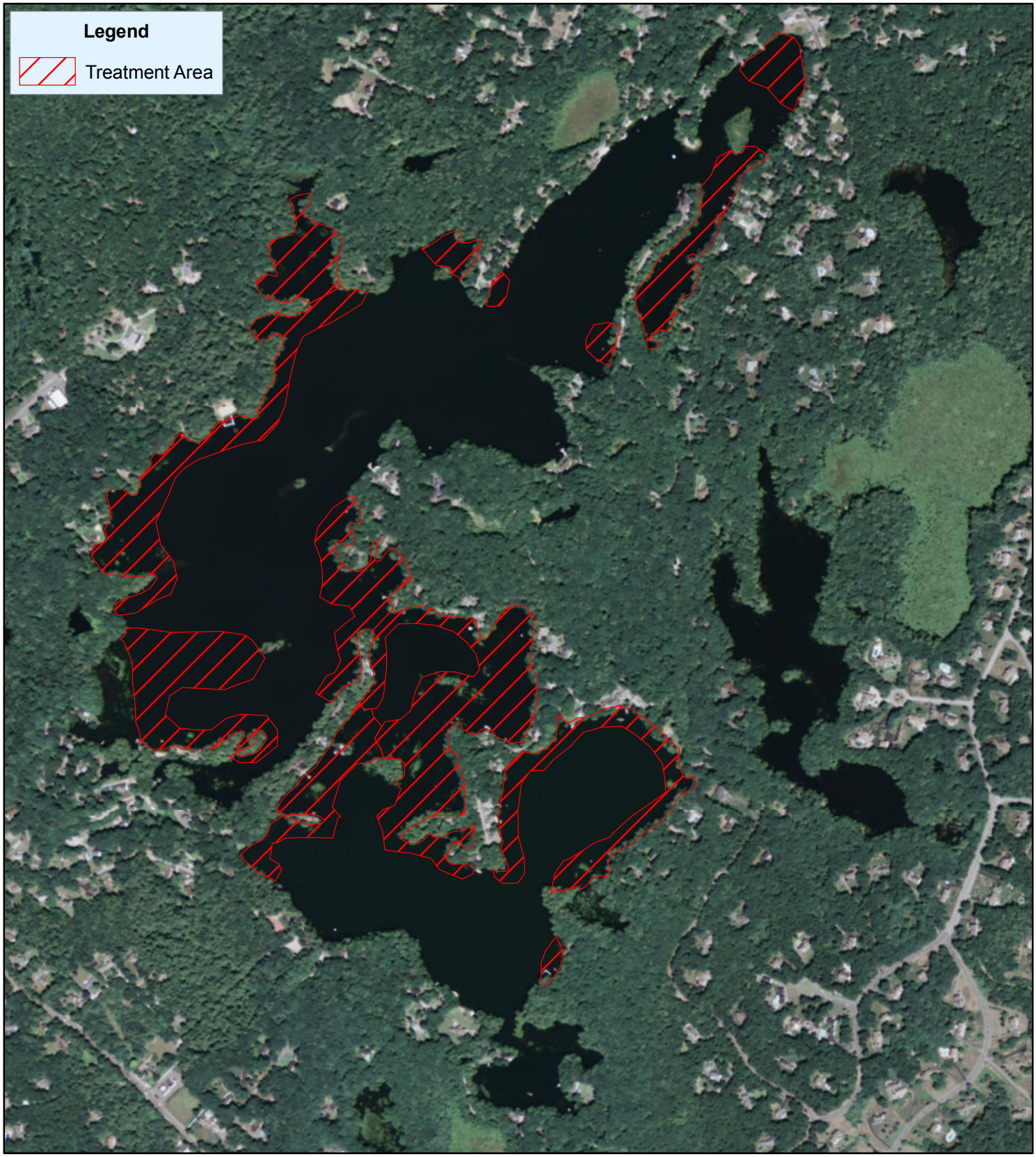

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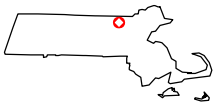

Lost Lake - Knops Pond

0 770 1,540
Feet
1:9,500

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Map Date: 06-09-17
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FIGURE 3: Post-treatment Distribution & Relative Abundance of Variable watermilfoil & Fanwort

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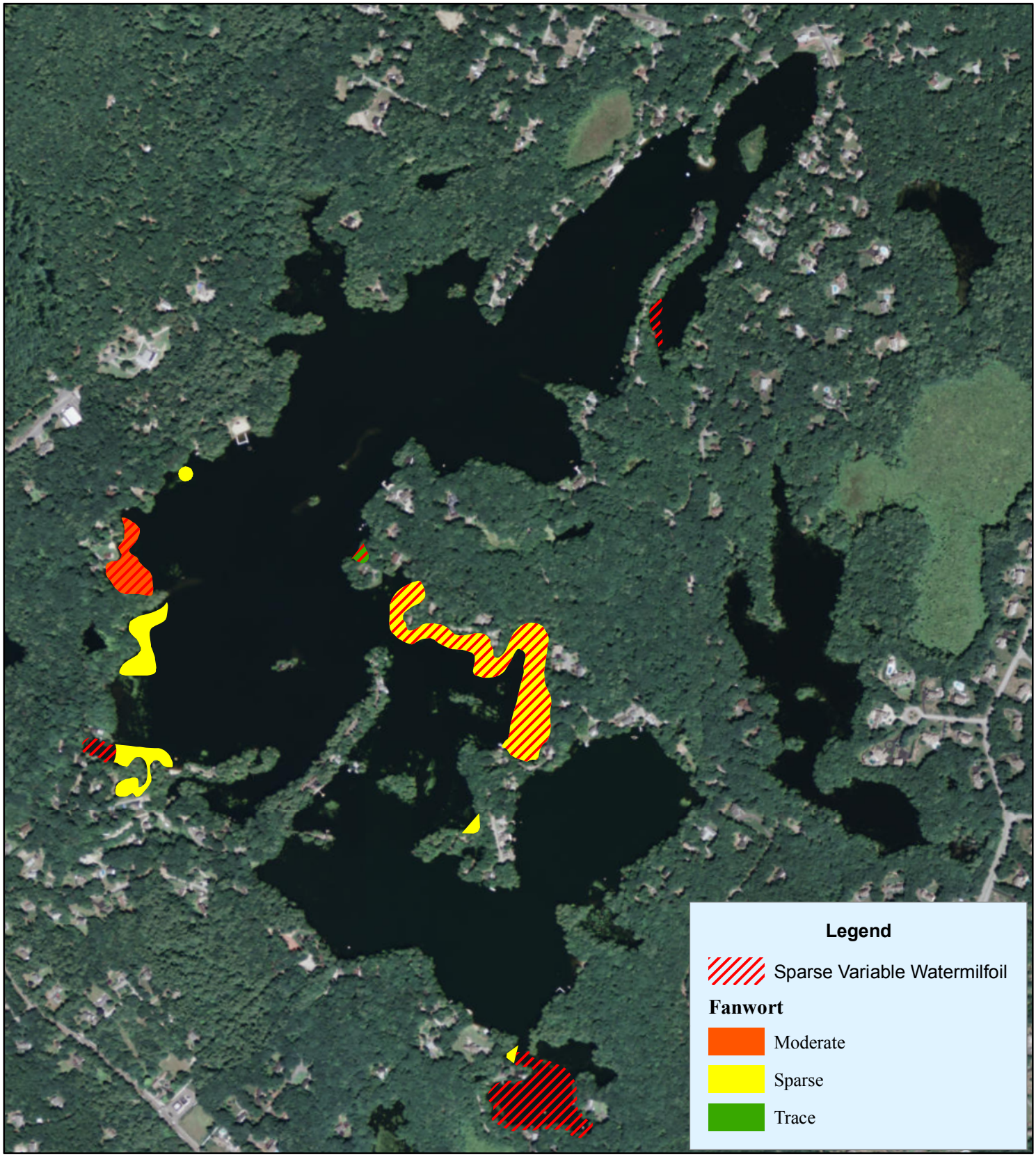

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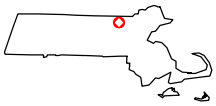

Lost Lake - Knops Pond

0 760 1,520

1:9,500 Feet

N

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FIGURE 4: Post-treatment Distribution of Native Aquatic Vegetation

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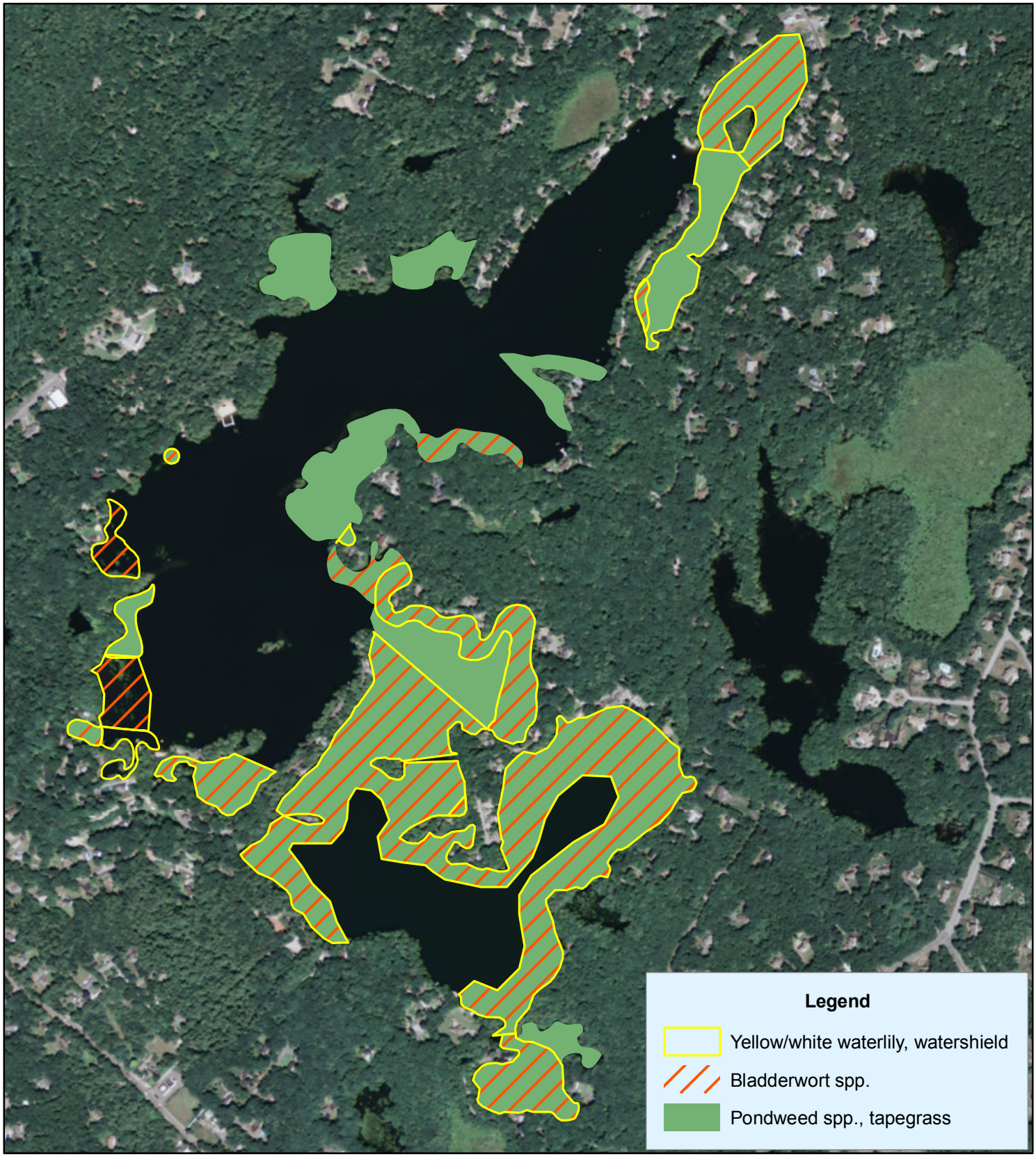

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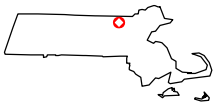

Lost Lake - Knops Pond

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Feet
1:9,500

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